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Asthma Education for Rural School Nurses: Resources, Barriers, and Outcomes

Marilyn L. Winkelstein, RN, PhD; Ruth Quartey, PhD; Luu Pham, MS; LaPricia Lewis-Boyer, LPN; Cassia Lewis, BS, CCRP; Kimberly Hill, BS; and Arlene Butz, RN, ScD

ABSTRACT: This paper describes a school-based asthma education program for rural elementary school nurses. The program was designed to teach school nurses in 7 rural counties in Maryland how to implement and to reinforce asthma management behaviors in children with asthma and their caregivers. Rural nurses who participated in this program increased their mean asthma knowledge scores more than nurses who did not take the program. The program also increased self-efficacy among intervention school nurses, but the difference in self-efficacy between intervention and control nurses was not statistically significant at follow-up. No effects on documentation or communication behaviors were noted. Only 25% of the nurses reported an interest in implementing future asthma educational programs for children with asthma. This study indicates the importance of understanding the unique characteristics of rural school nurses, the resources they need, and the barriers and challenges they face in their practice.

KEY WORDS: asthma education, asthma research, barriers to teaching, rural school nurses, self-efficacy

INTRODUCTION

Rural children with asthma are at risk for increased asthma morbidity due to environmental exposure to chickens, mice, cigarette smoke, pollen, molds, house dust mites, and fungi from silos, barns, and poultry processing plants (DoPico, 1996; Warren, 1989; Welch, Hogan, & Wilson, 2003). Recent studies of children living in rural Iowa indicated that children

from farm families have similar rates of asthma (about 12–13.4%) and levels of morbidity comparable to those of children from nonfarm families (Chrischilles et al., 2003; Merchant et al., 2004) and children in an urban environment (Amr et al., 2003). These authors concluded that triggers of asthma exacerbations are significant in the rural setting and strategies to improve asthma management in rural areas are essential.

Children spend approximately 35–50 hours per week in school, and rural school nurses who care for children with asthma are in an excellent position to influence asthma outcomes (Bucher, Dryer, Hendrix, & Wong, 1998; Huss, Winkelstein, Calabrese, & Rand, 2001). However, asthma management by rural school nurses is often less than optimal (Huss, Winkelstein, Calabrese, Nanda et al., 2001). Many rural school nurses do not use peak flow meters to assess asthma severity, do not have age-appropriate asthma educational programs in their schools, and do not communicate or collaborate adequately with parents and primary health care providers in the management of children with asthma (Calabrese, Nanda, Huss, Win-

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kelstein, Quartey, & Rand, 1999; Huss, Winkelstein, Calabrese, Nanda, et al., 2001).

The school-based asthma education program was an important component of a larger research project designed to improve the quality of life of rural school-age children with asthma and their caregivers (Butz, Pham, Lewis, Hill, Walker, & Winkelstein, 2005). The asthma education was designed to teach rural school nurses how to improve asthma management of children in the school setting. This paper describes this educational intervention and discusses the resources and barriers encountered in the implementation of the program and the effectiveness of the program in increasing asthma knowledge, self-efficacy, and documentation practices of rural school nurses.

BACKGROUND

The Precede health behavior model (Green, Kreuter, Deeds, & Partridge, 1980) provided the theoretical foundation for the education program. The Precede model is based on the assumption that health problems (such as asthma) are linked to behaviors that are influenced by predisposing, enabling, and reinforcing factors that precede or influence specific health behaviors (Figure 1). Predisposing factors that could influence asthma management in rural schools are insufficient knowledge of asthma care and limited self-efficacy on the part of school nurses. Enabling factors are limited educational and community resources regarding teaching asthma self-management skills. Reinforcing factors are educational programs in the school setting, social support, and availability of health care services in the community. All of these factors can potentially influence the asthma management behaviors of rural school nurses. The goal of the asthma education program was to reinforce asthma management behaviors by providing rural school nurses with the education, resources, and consultation they need to provide improved asthma management for children with asthma and their parents/caregivers.

Resources

Community resources and social support are important enabling and reinforcing factors for asthma

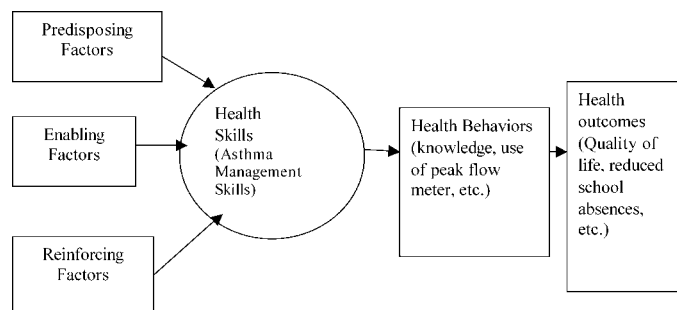


Figure 1. Precede Model Applied to Asthma Management

health behaviors in rural school nurses. Several specific resources were developed to enhance asthma education for rural school nurses, including convening a local advisory board. This board was assembled by the research team and met before the implementation of the asthma education program. The board identified resources in the rural community that would facilitate asthma education in the elementary schools and provided baseline information about cultural and economic values of the community and local patterns of access to health care. Board members included county school health nursing supervisors, county health department representatives, a pediatric allergist, and an agricultural scientist. All individuals had expertise in asthma or environmental risk factors associated with asthma morbidity in the rural population. Members of the board provided scientific oversight and clinical insight for program development and assisted in validation of the study protocols and strategies. Board members reviewed and approved all the educational materials used in the asthma education program.

Another resource was the *School Health Personnel Training Manual* developed by the research team after consultation with the local advisory board. This manual contained information about the asthma education program and content on basic asthma pathophysiology, asthma medications, factors influencing asthma care, environmental control measures, communications with the caregivers and primary care providers, adherence, cultural and ethnic sensitivity, home visit guidelines, and community resources. Each section had individual learning objectives and a list of references. All school nurses in the intervention group received a copy of the resource manual at the beginning of the program.

A third resource was the Rural Nurse Consultant (RNC), a registered nurse from one of the rural counties who was recruited for the asthma education project. The RNC provided continuity, support, and communication with the rural community. She was responsible for implementing the asthma education for the children with asthma and their parents/caregivers who were enrolled in the larger research project. She was certified as an asthma educator by the National Asthma Educator Certification Board and supervised the delivery of the asthma education program to the school nurses. She used a "train-the-trainer" approach in her interactions with the school nurses.

After delivering the asthma education to the school nurses, the RNC served as a resource and consultant to nurses in the intervention group. Not only was she always available by telephone, but she made frequent visits to the intervention nurses at their schools. She reinforced specific asthma management behaviors in the schools, such as encouraging the nurses to obtain and use asthma action plans (AAPs) and peak flow meters. She encouraged the school nurses to participate

in the asthma workshops that she conducted for the children and their parents/caregivers, and was available to make home visits to any of the intervention children with asthma and their caregivers if the nurses requested.

Barriers

Several barriers to conducting the educational program for the school nurses were encountered over the study period. Barriers to implementation of the intervention varied from county to county. However, time constraints for providing the educational workshops to the intervention nurses were present in all the counties. The school nurses had limited time for education, and most of the workshops had to coincide with their professional development days scheduled at the beginning of the school year. Finding a workshop location that was convenient to all school nurses was a major hurdle in several counties. Because schools in the rural communities often were located many miles apart, many school nurses had to travel 1–2 hours between their schools and the workshop location. Distance was such a significant barrier that the workshops had to be scheduled far in advance to accommodate school schedules and to enable the nurses to plan for attendance.

Other barriers to implementation included the demand that the county receive monetary compensation for the time spent by school nurses at the educational workshops, as well as the restriction that school nurses complete research questionnaires only during their free time and not during school work hours. This constraint meant that members of the research team often made several additional telephone calls to the school nurses in the evenings and on weekend days, sent reminder cards, and drove long distances to pick up study questionnaires. In some cases, these constraints interfered with adherence to the overall timeline for the research project.

Another barrier to implementation occurred during the recruitment phase. The Institutional Review Board of the Johns Hopkins Medical Institutions approved all aspects and procedures of this study, and informed written consent was obtained from every parent/caregiver and school nurse who volunteered to participate in the study. However, to maintain confidentiality of school health records, recruitment of the children with asthma and their parents/caregivers was conducted by the rural school nurses in the schools and counties involved in the study. The research team provided permission slips to the schools and the school nurses sent the slips home to the parents/caregivers. To be included in the study, children had to meet the following inclusion criteria: (a) have physician-diagnosed asthma, (b) take prescription medications for asthma, (c) have at least one asthma symptom (i.e., wheezing, shortness of breath, nighttime cough,

wheezing with exercise or colds) within the past year, and (d) awaken at night within the past 6 months with coughing, wheezing, shortness of breath, or chest tightness. Some schools applied their own additional criteria for recruitment. For example, in one school, the nurses only sent information about the study and permission slips to families of children who were known to have severe asthma or to children who visited the health room on a regular basis, rather than distributing information and permission forms to all children who met the inclusion criteria. Because school participation was voluntary, the school principal and/or school nurse in each school could decide whether or not they wished to participate. Consequently, in one county, only 2 school nurses out of 16 chose to participate in the study.

Transfers of nurses from school to school and resignations made it difficult for the research team to establish prolonged contact with the nurses and hindered communication between the nurses and the RNC. This lack of communication made it difficult to determine motivators for participation in the educational training program. Although the research team offered continuing education units (CEUs) to all school nurses who participated in the training, earning CEUs did not serve as a motivator, because continuing education is not a requirement for state license renewal or job security. However, providing breakfast and lunch, as well as time to socialize at the educational training program, was an important motivator for the school nurses and was appreciated greatly by them.

METHODS

Selection of Subjects

School nurses and health assistants were recruited from boards of education or county health departments. Prior to starting the study, the research team met several times with the board of education or county health department personnel in each county to inform them of the study and to obtain their approval and support. Seven rural counties volunteered to participate; there were no significant demographic differences among the counties (Table 1). The counties were randomized to either intervention or control group by the research statistician. Randomization was done at the county level to eliminate potential contamination of the sample, because some school nurses worked at several schools in the same county. Forty-one elementary schools volunteered to participate. Letters containing an invitation to participate, an informed consent form, and a baseline questionnaire were sent to all school nurses and health assistants in the participating schools. If a school nurse or assistant wished to participate, they returned the informed consent and baseline questionnaire in a prepaid, return-addressed envelope. Sixty-four school nurses were el-

igible for participation, but 14 nurses in one county elected not to participate because of time constraints. As a result, 50 school nurses consented, and 4 did not return their completed questionnaires. Thus, 46 school nurses were enrolled at baseline for an overall response rate of 72%. Eighteen school nurses were in the control group and 28 were in the intervention group. There were no significant demographic differences between the groups at baseline, but nurses in the control group worked with significantly more children and cared for more children with asthma (Table 2).

Asthma Educational Workshop

Intervention school nurses attended a 6-hour training session designed to teach them asthma management skills for the school setting. The session contained content on asthma pathophysiology, rural environmental triggers and irritants, and current information about asthma medications and delivery

devices. The train-the-trainer model provided the basis for educating the school nurses, and hands-on

Intervention school nurses attended a 6-hour training session designed to teach them asthma management skills for the school setting.

demonstrations were an essential part of the program. During the training program, school nurses practiced using peak flow meters, placebo asthma medications, and delivery devices (i.e., metered dose inhalers, spacers, and nebulizers) until they could demonstrate proficiency with these devices. At the training session, the RNC stressed the importance of encouraging all parents/caregivers of children with asthma to obtain an AAP from their primary care provider. Each intervention nurse was given a dollhouse to use in the health suite to help children to identify environmental asthma

Table 1. Selected Demographic Characteristics of Rural Counties

Characteristic	County 1	County 2	County 3	County 4	County 5	County 6	County 7
Total population ^a	30,861	30,612	44,108	92,746	19,680	34,670	49,604
Race ^a							
Caucasian	81.7%	69.4%	89%	93.4%	79.6%	82%	81.2%
African American	14.8%	28.4%	8.8%	3.9%	17.4%	15.4%	16.7%
Other	3.5%	2.2%	2.2%	2.7%	3.0%	2.6%	2.1%
Median household income ^b	\$38,142	\$33,448	\$59,854	\$51,293	\$40,412	\$46,637	\$40,565
Poverty status ^b	10.4%	13.5%	5.6%	7.3%	10.3%	7.9%	9.4%
Asthma prevalence ^c	6.7%	7.0%	6.4%	8.1%	7.3%	5.3%	8.8%

^a From U.S. Census Bureau (2003).

^b From U.S. Census Bureau (2000).

^c From State of Maryland Department of Health and Mental Hygiene (2003).

Table 2. Demographic Characteristics of School Nurses at Baseline

Characteristic	Intervention (<i>n</i> = 28)	Control (<i>n</i> = 18)	Statistical Significance
Gender			
Women	27 (96%)	18 (100%)	chi-square = 0.05
Men	1 (4%)		<i>p</i> = .82
Mean age	46 years	45 years	<i>t</i> = -0.39, <i>p</i> = .70
Race Caucasian	28 (100%)	18 (100%)	
Nurses with Asthma	1 (4%)	2 (11%)	chi-square = 0.16
			<i>p</i> = .68
Job title			
Nurse practitioner		1 (6%)	chi-square = 6.22
Registered nurse	20 (71%)	13 (71%)	<i>p</i> = .10
Licensed practical nurse	8 (29%)	1 (6%)	
Health room assistant		3 (17%)	
Educational level			
High school	1 (4%)	3 (17%)	chi-square = 6.70
Associate degree	5 (18%)	5 (28%)	<i>p</i> = .15
Bachelor's degree	10 (35%)	6 (33%)	
Master's degree	1 (4%)	2 (11%)	
Unspecified	11 (39%)	2 (11%)	
Mean number of years in school nursing	7.4	7.7	<i>t</i> = .18, <i>p</i> = .89
Number of schools	1	1	<i>t</i> = -1.40, <i>p</i> = .17
Mean number of children in school	425	543	<i>t</i> = 2.44, <i>p</i> = .02
Mean number of children with asthma	30	42	<i>t</i> = 2.39, <i>p</i> = .02

ma triggers and an Environmental Protection Agency school kit to help them to identify, to solve, and to prevent indoor air quality problems in their school. Finally, intervention school nurses received a resource guide with a directory of services provided by local governmental and private agencies; the *School Health Personnel Training Manual*; the National Heart Lung and Blood Institute videotape, *Making a Difference Asthma Management in Schools*; a booklet entitled *Nurses: Partners in Asthma Care*; peak flow meters for use in the school health suite; and the consultation services of the RNC.

During the training program, school nurses practiced using peak flow meters, placebo asthma medications, and delivery devices until they could demonstrate proficiency with these devices.

School nurses in the control group received the resource guide; the *Making a Difference Asthma Management in Schools* videotape; the *Nurses: Partners in Asthma Care* booklet; and peak flow meters. No educational training was provided, and they did not receive any consultation with the RNC.

Study Instruments

All school nurses completed a baseline questionnaire with questions relating to demographic characteristics, asthma knowledge, asthma self-efficacy, and asthma documentation and communication practices at the beginning of the study before the asthma educational training was delivered to the intervention nurses. All school nurses completed the same questionnaire at follow-up 1 year later.

Asthma knowledge was measured by a 20-item questionnaire that contained items related to the instruction presented in the training session and the *School Health Personnel Training Manual*. Each questionnaire item had four response options with one correct answer. Total asthma knowledge scores could vary from 0–20 points. A score of 16 correct answers (80%) was considered passing. Content validity for this questionnaire was high, as reported by an expert panel consisting of a pediatric allergist and two pediatric nurse practitioners. Cronbach's alpha reliability of the knowledge questionnaire was moderate at .67.

Asthma self-efficacy was measured by a 15-item questionnaire that contained items designed to reflect the components of the training session and the degree of confidence that the school nurse had in performing asthma management activities such as teaching children how to use a peak flow meter. Participants provided responses on a 7-point Likert scale ranging from 1 (indicating "never confident") to 7 (indicating "ex-

tremely confident"). Total scores could vary from 15–105 points, with higher scores indicating greater confidence. Cronbach's alpha reliability for this instrument was .73.

Documentation of asthma management and communication activities was measured by a 17-item questionnaire designed to measure how frequently the school nurse performed specific asthma management or communication activities, such as using peak flow meters in the health suite and telephoning caregivers or primary care providers. Participants provided responses on a 5-point Likert scale ranging from 1 (indicating "never") to 5 (indicating "all the time") for each activity or communication. Total scores could vary from 17–85 points, with higher scores representing more frequent documentation and communication.

RESULTS

Asthma Knowledge

After the educational program, the mean asthma knowledge score of the intervention school nurses increased from 15.57 points to 17.15 points, whereas the mean score of the control nurses remained at 17.47. The increase in asthma knowledge for the intervention nurses was statistically significant. Despite the increase in asthma knowledge scores for intervention nurses, the difference between the groups was not statistically significant at follow-up. Examination of the number of correct knowledge items between baseline and follow-up indicated that intervention nurses had a greater increase in the number of correct answers from baseline to follow-up than control nurses had. Individual item analysis also indicated that more intervention nurses answered the item relating to immediate management of an asthma episode in the school setting correctly than did nurses in the control group (Table 3).

Despite the increase in asthma knowledge scores for intervention nurses, the difference between the groups was not statistically significant at follow-up.

Asthma Self-Efficacy

Although the intervention school nurses had greater self-efficacy scores at follow-up than the control nurses had, the difference between the groups was not statistically significant (Intervention mean = 5.67; Control mean = 5.52; $t = -.6$; $p = .55$). There was no correlation between asthma knowledge and self-efficacy for either group of nurses at baseline or follow-up. No significant differences between the groups in

total mean documentation scores were noted at baseline or follow-up.

Evaluations From School Nurses

A telephone survey of all school nurses (*n* = 41) was conducted 1 year after the research project was finished to obtain their evaluations of the education program. A standardized interview questionnaire was used, and responses were obtained from 28 (68%) school nurses. Eighty-five percent of the nurses listed the education training session as the best part of the study. Seventy percent said they used the workshop information about peak flow meters, spacers, metered dose inhalers, asthma medications, how to communicate with children, and how to obtain AAPs from the primary care providers in their nursing practice in the schools. However, only 7 (25%) of the school nurses said they would be interested in conducting an asthma education program independently in their schools in the future. Time constraints and a lack of confidence in their teaching ability were the primary reasons that the school nurses were not interested in conducting an asthma education program.

Seventy percent said they used the workshop information about peak flow meters, spacers, metered dose inhalers, asthma medications, how to communicate with children, and how to obtain AAPs from the primary care providers in their nursing practice in the schools.

DISCUSSION

These results indicate that providing education to rural school nurses can increase their asthma knowledge, because intervention nurses who received the asthma education increased their knowledge scores significantly from baseline to follow-up. However, it

must be noted that the two groups had significantly different mean knowledge scores at baseline (Table 3). This is a limitation of the study and may have been related to the fact that school nurses and health assistants in the control group were responsible for more total children and took care of more children with asthma. It is also interesting to note that although the control nurses had higher knowledge scores at both baseline and follow-up, almost half of them (47%) answered the question about management of an asthma episode in the school setting incorrectly at follow-up, whereas 88% of the intervention nurses answered this question correctly.

Although the difference in self-efficacy between the groups was not significant at follow-up, data indicate the asthma education program was successful in increasing self-efficacy among school nurses in the intervention group. This finding is congruent with a previous study indicating that education programs can increase school nurses' self-confidence in managing asthma (Bullock, Libbus, Lewis, & Gayer, 2002).

IMPLICATIONS FOR SCHOOL NURSING PRACTICE

The results of this study indicate that more school nurses who received the asthma education program answered a critical thinking question about asthma management correctly (Table 3). This is important because caring for children during asthma episodes is one of the most frequent activities that school nurses perform (Borgmeyer, Jamerson, Gyr, Westhus, & Glynn, 2005; Bucher, Dryer, Hendrix, & Wong, 1998; Calabrese, Nanda, Huss, Winkelstein, Quartey, & Rand, 1999). It is essential that school nurses know how to respond during these episodes and that they feel comfortable implementing nursing interventions. Management of acute asthma episodes was emphasized in the education program, and special efforts were made to teach intervention nurses how to use metered-dose inhalers, spacers, and nebulizers to administer asthma medications. The school nurses who received this education indicated that it was very im-

Table 3. Analysis of Asthma Knowledge Scores and Individual Knowledge Items

Mean	Intervention Group (<i>n</i> = 26) ^a	Control group (<i>n</i> = 15) ^a	Statistical Significance
Mean total score at baseline (range = 0–20)	15.57 (78%)	17.47 (87%)	<i>t</i> = 3.15, <i>p</i> = .004
Mean total score at follow-up (range = 0–20)	17.15 (86%)	17.47 (87%)	<i>t</i> = 0.64, <i>p</i> = .53
Mean change in total score (baseline to follow-up)	1.58	–0.07	Wilcoxon rank sum = 107, <i>p</i> = .03
Critical thinking item: A child with moderate persistent asthma comes to the health room with wheezing that started while running on the playground. The first thing the school nurse should do is have the child: (a) drink several glasses of water; (b) relax by taking several fast deep breaths; (c) take his/her controller medication; (d) take his/her quick reliever medication. ^b	23 (88%)	7 (47%)	chi-square = 6.469 <i>p</i> = .01

^a Data unavailable at baseline or follow-up for two control nurses and three intervention nurses.
^b Correct answer.

portant to them; 70% stated they used information from the workshop in their daily nursing practice.

Although the train-the-trainer model successfully increased asthma knowledge and self-efficacy, the model was not successful in empowering rural school nurses to provide educational programs to children with asthma and their parents/caregivers. Only 25% of these nurses were interested in providing asthma education independently in the future.

Although the train-the-trainer model successfully increased asthma knowledge and self-efficacy, the model was not successful in empowering rural school nurses to provide educational programs to children with asthma and their parents/caregivers. Only 25% of these nurses were interested in providing asthma education independently in the future. Although they stated that they had learned new asthma management skills and were applying these skills in their practice, many school nurses were not comfortable incorporating their new knowledge and skills into formal educational programs for children and their parents/caregivers. This result is especially interesting because health teaching is an expectation of the school nurse and an important part of the Scope and Standards of School Nursing Practice (National Association of School Nurses [NASN] & American Nurses Association, 2005). It is essential that school nurses feel comfortable teaching children and their parents/caregivers not only about asthma, but other health issues as well. A lack of comfort suggests that rural school nurses may need continuing education programs that provide them with the opportunities and confidence that they need to actually develop, teach, and manage formal health education programs.

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Lack of time was another reason that rural school nurses reported they would not be able to implement

a formal asthma education program in their schools. In their evaluations of the asthma program, many nurses stated that their hours had been cut back recently and they had no time for education. Previous studies of school nurses have indicated they have many responsibilities and little time and few resources to help them implement education programs (Heaman & Estes, 1997). However, recent reports of educational programs implemented by school nurses indicate that such programs are successful and have the potential to produce substantial results (Gregory, 2000; Mooney, 2005).

Lack of time was another reason that rural school nurses reported they would not be able to implement a formal asthma education program in their schools.

Future research should explore specific opportunities to provide rural school nurses with protected time and the resources they need to provide education in the school setting. For example, one study recommended the use of trained volunteers and nursing students to help school nurses (Heaman & Estes, 1997). The use of volunteers may be particularly relevant and appropriate in the rural setting, because studies have indicated that rural individuals are self-reliant and accustomed to relying on lay resources and a network of relatives and neighbors for help (Scharff, 1998). Nursing students would be a valuable resource, because nursing instructors are frequently in need of clinical practice sites, and rural elementary schools are an ideal setting for students to implement health education programs that are frequently required by child and community health undergraduate and graduate courses. Another resource for rural nurses is the *School Nurse Asthma Management Program Resource Manual* developed by the NASN (2004). This manual provides school nurses with the tools that they need to promote optimal asthma management for their students and provides an excellent foundation for rural school nurses and educators who wish to develop school-based asthma education programs.

Many nurses who participated in this research study commented that they lacked specific materials to provide adequate asthma education, and they were grateful that the research team had provided peak flow meters to the schools and the children enrolled in the study. School nurses should approach their local community leaders and businesses to determine whether these individuals and organizations are interested in buying peak flow meters and asthma devices, such as spacers and nebulizers, for their schools. Providing computers and access to computerized information systems on asthma and e-mail contact with asthma

experts, such as the RNC used in this study, are other resources that could be used by rural school nurses.

SUMMARY

. . . rural elementary school nurses continue to need time, educational materials, and confidence to implement asthma education programs independently.

This research study indicated that school-based asthma education can increase asthma knowledge and self-efficacy among rural school nurses. It also found that rural school nurses value such education and incorporate the knowledge and asthma management skills gained from these programs into their nursing practice. However, rural elementary school nurses continue to need time, educational materials, and confidence to implement asthma education programs independently.

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